4.8 Wildlife

This section assesses the potential impacts of the Proposed Action or alternatives on marine birds, mammals, and invertebrates, including threatened and endangered wildlife species. Effects are described by fishery gear type and location (i.e., marine and freshwater terminal areas).

4.8.1 Marine Birds

The susceptibility of marine birds as a bycatch of Puget Sound salmon fishing depends largely on three factors: the type of fishing gear, the occurrence of birds during the fishing seasons, and bird diving behavior. The following discussion considers the effects of five fishing methods: sport, purse seine, beach seine, reef net, and gillnet.

Noviello (1999) studied seabird interaction with the Strait of Juan de Fuca and Puget Sound "hook and line" sport fishery (Marine Catch Areas 4, 5, 8-2, and 10) in 1997 and 1998, and observed no bird mortalities in 1,090 observed "hook-ups." (The only birds hooked were four immature gulls, all released alive.)

Purse seine nets are usually built of heavy nylon twine, with a small mesh (3.5 to 4 inches) that is probably visible to diving seabirds. Such nets, therefore, are probably easily avoided, or easily escaped from, by most seabirds. Anderson (1993) found that of 179 seabirds (mainly rhinoceros auklets, common murres, pigeon guillemots, and western grebes) observed encircled by seine nets in the 1990 to 1992 Puget Sound coho and chum salmon fisheries, 74 percent escaped, 21 percent were entangled but released unharmed, and only 5 percent were killed or injured. The mortality rate for this fishery was a very low 0.026 seabirds killed per net set. Further, the Washington Department of Fish & Wildlife (WDFW) now requires that purse seines have at least four 12-inch cork-line bird openings to facilitate escape by captured seabirds. The small tribal and non-tribal beach seine fisheries are similar. Because they operate in shallow, nearshore water with constant human presence, few, if any, seabirds are captured in this fishery. Consequently, neither purse seine nor beach seine fisheries are substantial sources of seabird mortality.

Reef net fishing is practiced by non-tribal fishers in Marine Catch Areas 7 and 7A. Reef nets are highly selective fishing gear with a design that prevents bycatch mortality. The mesh size is sufficiently small (3.5 inches) to avoid entanglement as the net is lifted out of the water and the contents spilled into a holding pen. Non-target species are then released from the holding pen unharmed.

Gillnet fisheries have been shown to entangle seabirds throughout the world (e.g., Christensen and Lear 1977; Piatt and Nettleship 1987; DeGange et al. 1993; and Julian and Beeson 1998), including Puget

Sound (Pierce et al. 1995; and Melvin et al. 1999). Gill nets have mesh openings large enough (5 to 7 inches) to entangle seabirds, and are made of monofilament nylon line, which is virtually invisible to pursuit diving seabirds.

However, not all marine birds are susceptible to the Puget Sound gillnet fishery. Gulls, kittiwakes, jaegers, terns, phalaropes, and dabbling ducks generally do not face a risk of bycatch because they forage at the surface, rather than diving to depths where nets are used. Fulmars and shearwaters are pelagic seabirds that do not enter very far into the Strait of Juan de Fuca and, therefore, do not often encounter net fisheries. Other species of ducks do not arrive in Puget Sound in great numbers until the fisheries are nearly complete. Using fish landings as a basis of effort, 90 percent of the commercial salmon fishery in the Strait of Juan de Fuca and North Puget Sound is complete by October, and November fishing in all catch areas is generally 80 to 85 percent completed by November 15. Subsection 3.8.2, Marine Birds – Affected Environment, describes marine bird migration through the Puget Sound Action area. Further, sea ducks and diving ducks are generally not fast-pursuit predators, feeding instead on more sedentary benthic prey such as mussels, clams, crabs, and algae. Entanglement in gillnets may require birds striking the net at a fast speed.

Large numbers of western grebe overlap with the late-season chum fisheries (Courtney et al. 1997) and, because they are pursuit divers, would be expected show up in the bycatch. Currently-available data, however, do not indicate that western grebes are susceptible to the gillnet fishery. This apparent immunity may be due to the bird's nocturnal foraging behavior (Clowater 1998), but further research may be required to substantiate this explanation.

What remain are diurnal foraging pursuit predators such as cormorants, loons, and alcids like rhinoceros auklets, common murres, pigeon guillemots, and marbled murrelets (the latter are addressed further in Subsection 4.8.4, below). Loons and cormorants have been identified as bycatch in gillnet fisheries in Newfoundland (Piatt and Nettleship 1987), and California (Julian and Beeson 1998), but in small numbers. Although cormorants are found year-around in Puget Sound and the Strait of Juan de Fuca, they, along with loons, do not reach their seasonal peak until December, after almost all salmon fishing is complete. Pierce et al. (1996) and Melvin et al. (1999) observed no loon or cormorant entanglements during the seabird interaction studies of sockeye fisheries within Marine Catch Areas 7 and 7A.

All types of fishing gear can become lost as a result of entanglement with bottom structures, logs and debris, or because of storms, flood events and other occurrences. Of the gears used to harvest salmon, monofilament gillnet and angling gears are the most common gear types lost. Submerged gillnets

typically drift until they become entangled on submerged features or structures, where they may impact bottom-dwelling organisms. Seabirds, mammals, fish and other animals become entangled in derelict nets or entangle in or ingest monofilament fishing line. Nets and pots lying on the seabed continue to entangle fish and wildlife species for years after they are lost or abandoned.

In 2004, the Greystone Foundation provided funding to the Northwest Straits Foundation (NWSF), who contracted with Natural Resource Consultants to conduct derelict fishing gear removal in the Strait of Juan de Fuca and the San Juan Islands. In the 46 nets encountered in this project, 43 dead seabirds were recovered, and bone evidence below the nets suggests that hundreds and perhaps over one thousand other birds may have been killed. These results are too recent (April 5, 2004) for rigorous estimates of cumulative impacts to populations of seabirds, marine mammals and other wildlife to be available. Such estimates will allow managers to determine what relative impact this environmental problem is exerting on seabird and mammal populations.

Worldwide, alcids are the most common seabird caught in coastal gillnet fisheries, with common murres the most commonly caught species (Melvin et al. 1999). These birds are most susceptible because 1) they swim very rapidly in dive-pursuit of prey and, therefore, likely hit gillnets with enough force to cause entanglement; 2) they tend to form large aggregations; and 3) they tend to pursue a common prey with salmon (e.g., herring). Collectively, then, large numbers of these fast diving birds may be found in association with salmon, which are targeted by gillnet fishers, resulting in bycatch of the alcids. Recognizing that alcid mortality due to gillnet fishing is the only potentially substantial seabird fishery interaction issue, only pigeon guillemots, rhinoceros auklets, and common murres are addressed further in this subsection. Marbled murrelets are addressed in the Threatened and Endangered Species subsection (4.8.4 below).

Pigeon Guillemot

Guillemots have shown susceptibility to gillnet fisheries in some regions. Piatt and Nettleship (1987) estimated that the Newfoundland cod and salmon gillnet fishery killed approximately 2,000 black guillemots annually between 1981 and 1984. In contrast, Pierce et al. (1996) did not report the presence of pigeon guillemots during the 1994 sockeye fishery Marine Catch Areas 7 and 7A, and in a 1996 sockeye test fishery in Marine Catch Area 7, only one pigeon guillemot was caught in 642 gillnet sets (Melvin et al. 1999). Also, Julian and Beeson (1998) recorded no entanglements of pigeon guillemots during 1990 to 1994 gillnet fishing in central California that was killing up to 2,300 common murres annually (Forney et al. 2001). Guillemots in Washington are probably not susceptible to the Puget Sound gillnet fishery because they forage on gunnels, pricklebacks, and sculpins (Drent 1965; and

Koelink 1972), generally in shallow, nearshore waters. Gunnels, pricklebacks, and sculpins are more sedentary than schooling fish such as herring, and therefore probably do not require fast pursuit to capture.

Rhinoceros Auklet

Thompson et al. (1998) estimated that the 1994 sockeye fishery in Marine Catch Areas 7 and 7A killed less than 0.8 percent of the Washington breeding auklet population (36,800), well below the 6 percent mortality level where population stability concerns occur. Further, Thompson et al. (1998) observed no adults during the fall chum salmon fishery, confirming that most auklets winter outside Washington's inner marine waters (Angell and Balcomb 1982). Consequently, while the sockeye fishery in Marine Catch Areas 7 and 7A killed relatively large numbers of rhinoceros auklets in the 1990s, this mortality does not appear to exceed biological thresholds of concern.

Common Murre

WDFW estimated that the 1994 sockeye fishery in Marine Catch Areas 7 and 7A alone killed approximately 2,700 common murres (Pierce et al. 1996). If a constant rate of entanglement of murres is assumed throughout all Puget Sound fisheries (which is not realistic), and the Marine Catch Area 7 and 7A sockeye fisheries are assumed to represent about 45 percent of all fishing effort (based on number of landings during the period 1996 through 2001), then a maximum of about 6,100 murres may have been killed in 1994. If, following Thompson et al. (1998), 70 percent of the murres killed were adults, then the 1994 adult mortality may have been approximately 4,300. This represents 73 percent of the estimated 1994 Washington breeding population of 5,900 (Carter et al. 2001), well beyond the 6 to 12 percent mortality at which maintenance of a stable breeding population becomes difficult, if not impossible (Piatt et al. 1984). However, it is known that this degree of mortality was not the case. If the 1994 mortality exacted such a toll on the Washington breeding murre population, a dramatic decline would have been observed in the 1995 breeding population, rather than the observed doubling from 5,900 to 9,600 (Carter et al. 2001) or 13,600 murres (*TENYO MARU* Oil Spill Natural Resources Trustees 2000).

Based on the studies conducted by Thompson et al. (1998), a considerable, but unknown, proportion of the murres killed in the sockeye salmon fishery originated from Oregon, where the breeding population exceeds 700,000 (personal communication with Roy Lowe, U.S. Fish and Wildlife Service, Refuge Biologist, February 25, 2003). Thompson et al. contend that during the peak of the sockeye fishing season, Washington murres are still attending colonies, while Oregon murres, which complete their breeding cycle a month or more earlier, have already dispersed from breeding sites and then dominate

the waters of Puget Sound during the sockeye fishery. The exact ratio of Oregon versus Washington birds in the Puget Sound salmon fishery bycatch is currently unknown, however (Thompson et al. 1998), numbers of common murres found in Washington waters in late summer far exceed the Washington breeding population (Manuwal and Carter 2001). The maximum adult mortality of 4,300 murres is less than 1 percent of the combined Oregon and Washington breeding population, which is not a substantial proportion of the two-state population. Further, the Washington and Oregon birds are all part of a single subspecies (*Uria aalge californica*) that includes birds from California (approximately 350,000 adults), and British Columbia (approximately 10,000 adults) (Carter et al. 2001). Finally, given that fishing effort is now substantially lower than in the 1990s when the Pierce et al. (1996) and Thompson et al. (1998) studies were conducted (personal communication with Will Beattie, Northwest Indian Fisheries Commission, December 19, 2003), the significance of gillnet entanglement mortality in Puget Sound is likely further reduced. Nevertheless, current radio-telemetry studies by Hamel and Parrish are aimed at determining the presence of Washington-bred murres coincident with the salmon gillnet fisheries to verify whether this breeding population is at risk from Puget Sound fisheries (personal communication with Julia Parrish, University of Washington, Associate Professor, February 13, 2003).

4.8.1.1 Alternative 1 – Proposed Action/Status Quo

The Proposed Action would involve a fishery effort similar to (or substantially less than) the fishing that occurred in Puget Sound and the Strait of Juan de Fuca during the 1990s, except seabird bycatch would likely be greatly reduced during the Marine Catch Area 7 and 7A sockeye and pink salmon gillnet fishery, through the implementation of the "bird web" net design and dawn hours fishing restrictions originally proposed by Melvin et al. (1999). Net modification designs for purse seines and gillnets, and area and time closures are required by the Washington Department of Fish (WDFW) and Wildlife in areas frequented by marbled murrelets. WDFW requires that 1) gillnets fishing in Marine Catch Areas 7 and 7A use "bird webs" (a 20-mesh panel of small diameter, highly-visible white nylon across the top of the net); 2) purse seines in all areas have a 12-inch space between corks; 3) shoreline areas in Marine Catch Areas 7 and 12 close to gillnet fishing; and 4) gillnet fisheries remain closed during early morning hours. These requirements, estimated to reduce the seabird bycatch by approximately 70 to 75 percent (based on research results from Melvin et al. 1999), may ensure that the annual gillnet mortality of Washington common murres does not exceed the maximum mortality to sustain a stable population, although continued research is needed to ensure this is the case. Bycatch mortality of rhinoceros auklets and pigeon guillemots was considered to be well below significance levels prior to implementation of the bird bycatch reduction requirements (Pierce et al. 1996;

Thompson et al. 1998; and Melvin et al. 1999). These requirements should safely ensure the annual bycatch stays sufficiently low. Finally, the overall fishing effort in Marine Catch Areas 7 and 7A is considerably lower than that compared to effort in previous years which were the basis of the estimates in the Environmental Impact Statement evaluation.

4.8.1.2 Alternative 2 – Escapement Goal Management at the Management Unit Level

Under Alternative 2, no net fisheries would occur in marine areas with the exception of small-scale, nearshore, set gillnet, and beach seine fisheries in Dungeness Bay (Marine Catch Area 6D), Tulalip Harbor (Marine Catch Area 8D), and adjacent to the Hoodsport Hatchery in Hood Canal (Marine Catch Area 12H). Consequently, there would be no bycatch of alcids, or any marine birds for that matter. Therefore, fisheries under Alternative 2 are predicted to have no impact to marine bird populations. This alternative would entirely eliminate the small bycatch predicted to occur with the Proposed Action (Alternative 1). Because marine bird bycatch would not occur under Alternative 2, it would be considered to have a beneficial impact when compared to Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.1.3 Alternative 3 – Escapement Goal Management at the Population Level with Terminal Fisheries Only

The scale and distribution of marine net fisheries for salmon under Alternative 3 would be similar to those under Alternative 2, except that all potential salmon harvest would be limited to freshwater terminal areas (major rivers) only. No salmon fishing of any kind would occur in the Strait of Juan de Fuca or Puget Sound marine waters. The small fisheries occurring in Dungeness Bay, Tulalip Harbor and adjacent to the Hoodsport Hatchery under Alternative 2 would not occur under Alternative 3. Consequently, there would be no bycatch of alcids, or any marine birds. As with Alternative 2, Alternative 3 would entirely eliminate the small bycatch predicted to occur with the Proposed Action (Alternative 1). Because marine bird bycatch would not occur with Alternative 3, it would be considered to have a beneficial impact when compared with Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.1.4 Alternative 4 – No Action/No Authorized Take

Like Alternative 2 or 3, Alternative 4 would preclude all marine-area fisheries. No fishing would occur in any habitat, including habitats occupied by alcids or other seabirds susceptible to gillnet mortality. Therefore, Alternative 4 would have no impact to regional marine bird populations. Like Alternative 2 or 3, this alternative would completely eliminate the small marine bird bycatch that would occur under Alternative 1. Because this bycatch would not occur under Alternative 4, it would be considered to

have a beneficial impact when compared with Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.2 Marine Mammals

The National Marine Fisheries Service (NMFS) is required under the Marine Mammal Protection Act to periodically reassess each stock of marine mammal species, determine a minimum population estimate, then calculate a Potential Biological Removal (PBR) value. The PBR, unique to each species, is the estimated number of marine mammals that could be killed or seriously injured by human activities without depleting the stock (Barlow et al. 1995). Generally, stock PBRs are 6 percent of the minimum estimated stock size. NMFS is further mandated to regulate fisheries in a manner towards achieving a goal of zero mortality or serious injury to marine mammals. NMFS has proposed ~~considers~~ that fisheries are achieving this goal when the annual mortality of a given marine mammal species is less than 10 percent of the PBR (69 FR 23477). NMFS also annually publishes in the Federal Register a list of all fisheries (Annual List of Fisheries) classifying each as to its potential impact to individual stocks. In the 2003 List of Fisheries (NOAA 2003), Washington beach seine, salmon purse seine, and salmon reef net fisheries were all classified as Category III – no documented marine mammal mortality with potential mortality less than 1 percent of PBR. The Washington Puget Sound Region salmon drift gillnet fishery (excluding treaty fishing) was classified in 1995 as Category II (60 FR 67063) with documented mortality of harbor porpoise, Dall's porpoise, and harbor seal between 1 and 50 percent of PBR. However, ~~NMFS (2000a)~~Carretta et al. (2004) used Laake et al.'s (1997) estimate of 3,509 animals to calculate a minimum population estimate of 2,545 and a PBR of 20 animals for the Washington Inland Waters stock of harbor porpoise. In the 1995 evaluation, NMFS noted that the estimated take of harbor porpoises at the time (15) exceeded 10% of PBR (2.7) and therefore could not be considered insignificant. However, NMFS further reported that the take estimate was derived from observations in the sockeye salmon fishery and included treaty fishing effort, which constitutes about one half of the effort in Puget Sound, but is exempted under the Marine Mammal Protection Act. Therefore the estimated take of harbor porpoise for the non-tribal salmon drift gillnet fishery would be about one half of the total estimated take (7.5), which is greater than one percent but less than 50 percent of the calculated PBR for the stock. Since that time the effort in the fishery has been reduced through license buy back programs and the number of active participants in the non-tribal fishery declined from 1,044 in 1995 to 210 in 2003 (69 FR]. Further, gear modifications and changes to daylight fishing periods for the benefit of endangered seabirds are likely also beneficial for reducing interactions with harbor porpoises. Commercial fishers are required, by regulation, to report incidental marine mammal injuries or deaths to NMFS ~~Then, using Pierce et al.'s (1996) estimate of 15 harbor~~

~~porpoise killed in the 1994 sockeye gillnet fishery, NMFS (2000a) concluded that although the estimated annual mortality (15) did not exceed PBR (20), at 75 percent PBR it was not insignificant nor approaching zero mortality and serious injury rate. Fishermen are currently required by NMFS to provide reports of lethal encounters with Category II marine mammals~~ (personal communication with Brent Norberg, NOAA Fisheries Northwest Region, April 4, 2003). This allows NMFS to monitor the impacts to harbor porpoise in the Puget Sound salmon drift gillnet fishery. If patterns of interactions emerge, this information could be used to shape fisheries to further reduce harbor porpoise-fishing gear interactions.

NMFS (~~NMFS 2000b~~Carretta et al. 2004) has not calculated an annual mortality rate for Dall's porpoise as a result of the Puget Sound salmon fishery. However, the calculated PBR of ~~787~~ 789 for the California/Oregon/ Washington stock (minimum population estimate = 75,915) is sufficiently high that the potential annual mortality is unlikely to exceed 10 percent of the PBR and, therefore, should be approaching a zero mortality or serious injury rate.

~~NMFS (1998)~~Carretta et al. (2004) estimated the minimum population size of the Inland Washington stock of harbor seal at ~~16,104~~ 12,844, and calculated a PBR of ~~966~~ 771 animals. Professing that no reliable estimate of annual mortality incidental to commercial fisheries was available because of a lack of sufficient observer effort, ~~NMFS (1998)~~ Carretta et al. (2004) used available data (Gearin et al. 1994; Pierce et al. 1996; and Erstad et al. 1996), and estimated the annual mortality from all Washington fisheries at ~~36~~ 30 animals, well less than 10 percent of PBR.

Although California sea lions are susceptible to gillnet entanglement, deaths from entanglement in the Puget Sound gillnet fisheries has not been reported (~~NMFS 2000c~~Carretta et al. 2004). This is partially due to the fact that peak abundances of California sea lions in Puget Sound occur in winter and spring after most salmon fisheries are complete (NMFS 1997). California sea lions do interact with tribal gillnet fisheries in terminal areas for winter run steelhead and chum salmon. In order to protect their fisheries, tribal fisherman legally harvest a number of these depredating sea lions under subsistence regulations (personal communication with Will Beattie, Northwest Indian Fisheries Commission, December 19, 2003). These removals, however, are negligible compared to the minimum population estimate of ~~110,000~~ 138,881 for this stock, and it's PBR of ~~6,143~~ 8,333 (~~NMFS 2000c~~Carretta et al. 2004).

NMFS Annual List of Fisheries only classifies commercial fisheries, not sport fisheries. However, Noviello (1999) did study the potential impact of Puget Sound sport fisheries on marine mammals during the 1997 and 1998 seasons. During this study, no marine mammal hook-ups or entanglements

were observed in 1,090 hook-up observations, although NMFS and WDFW have received a substantial number of reports of seal and sea lion interations with salmon sport fisheries. These interactions include losses of fish off lines at Neah Bay, Sekiu, Point No Point, Point Defiance, and off the Nisqually River. The sport fishery probably does not represent a ~~potential~~ substantial source of mortality for marine mammals, although anglers do shoot seals and sea lions based on anecdotal reports and observed strandings with bullet wounds (personal communication with Steve Jeffries, WDFW, Research Scientist, July 30, 2004).~~.~~

4.8.2.1 Alternative 1 – Proposed Action/Status Quo

Under Alternative 1, mortality levels of marine mammals as a result of Puget Sound fisheries would likely be similar to those observed during the 1990s, or considerably less if shortened fishing seasons and declines in fishing effort continue. Gillnet fisheries would be expected to result in the incidental ~~capture~~ mortality of small numbers of harbor seals, harbor porpoise, and Dall's porpoise and the removal of California sea lions predating on entangled salmon. Mortality rates would continue to be low compared to stock population levels, however, and management concerns would therefore not be warranted. However, NMFS acknowledges that these mortality rates are based on limited data and that further data is needed for more accurate estimates of mortality rates.

4.8.2.2 Alternative 2 – Escapement Goal Management at the Management Unit Level

Under Alternative 2, no salmon fishing would occur in marine waters, only freshwater rivers except for small-scale, nearshore fisheries in Dungeness Bay (Marine Catch Area 6D), Tulalip Harbor (Marine Catch Area 8D), and adjacent to the Hoodsport Hatchery in Hood Canal (Marine Catch Area 12H); therefore, most of the marine mammals inhabiting Puget Sound would not come in contact with fisheries managed under Alternative 2. Harbor seals and California sea lions would be exceptions, as both commonly enter freshwater rivers (Stanley and Shaffer 1995; and NMFS 1997), and even lakes (Scheffer and Slipp 1948). NMFS (1997) stated that the 2,000 to 3,000 harbor seals ~~annually enter~~in the Columbia River during the winter forage on~~in pursuit of~~ eulochon runs that move upstream to spawn. California sea lions also forage on the eulachon run as it enters the Columbia River; shifting to predation on spring chinook as it becomes more abundant~~, and~~. California sea lions are also commonly observed in the Duwamish, Green, and Nisqually Rivers. Consequently, it is possible for harbor seals and~~,~~ California sea lions to encounter, and possibly become entangled in, gillnets set in terminal river locations. However, there is currently no evidence of harbor seal or sea lion entanglement mortality associated with terminal fisheries in the Strait of Juan de Fuca or Puget Sound region, although this may be due to a lack of observer data and declines in self-reporting. The level of self-reporting after

1995 dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (Carretta et al. 2004). ~~although s~~Some animals are legally harvested in the rivers under tribal subsistence regulations. There have been only a few reported takes of harbor seals from directed tribal subsistence hunts. It is possible that very few seals have been taken in directed hunts because tribal fishers use seals caught incidentally to fishing operations for their subsistence needs before undertaking a ceremonial or subsistence hunt. From communications with the tribes, the NMFS Northwest Regional Office (personal communication with J. Scordino as cited in Carretta et al. 2004) believes that 5-10 harbor seals from this stock may be taken annually in directed subsistence harvests off the Washington coast. Therefore, the combination of harbor seals and sea lions from taken in subsistence fisheries and those potentially caught incidentally in salmon fisheries, as estimated from available data, would be low and ~~se removals do~~would not exceed biological thresholds of concern (greater than 10 percent of PBR). Further data is needed for more accurate estimates of mortality rates.

The increased in-river harvest opportunity available in some areas under Alternative 2, relative to Alternative 1, would result in higher freshwater gillnet fishing effort. The number of vessels involved would increase in some areas, and fishery openings would likely be extended in these areas, relative to Alternative 1. However, such an increase in freshwater fishing, combined with almost no marine-area fishing, would still result in overall lower mortality of harbor seals and sea lions, compared to Alternative 1. Therefore, the potential marine mammal mortality associated with Alternative 2 is likely ~~extremely~~ low for harbor seals and California sea lions, and zero for all other marine mammals. Compared to Alternative 1, Alternative 2 would eliminate any bycatch concerns with harbor porpoise and other cetaceans. Because this bycatch would not occur under Alternative 2, it would be considered to have a beneficial impact when compared with Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.2.3 Alternative 3 – Escapement Goal Management at the Population Level with Terminal Fisheries Only

Under Alternative 3, gillnet fisheries for salmon would occur at virtually the same times and in virtually the same places as under Alternative 2, so the impacts of gillnet fisheries to marine mammals would be the same. No salmon fishing would occur in marine waters, only freshwater rivers; therefore, the potential marine mammal mortality associated with Alternative 3 is likely ~~extremely~~ low for harbor seals and California sea lions, and zero for all other marine mammals The more restrictive fisheries in Alternative 3 would slightly decrease the potential for interactions with harbor seals (and California sea lions) in particular, relative to Alternative 2. Compared to Alternative 1, Alternative 3 would eliminate

any bycatch concerns with harbor porpoise and other cetaceans. Because this bycatch would not occur under Alternative 3, it would be considered to have a beneficial impact when compared with Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.2.4 Alternative 4 – No Action/No Authorized Take

Under Alternative 4, no salmon fishing would occur in marine waters. Therefore, Alternative 4 would have no potential for impact to marine mammals, with the exception of a possible extremely low mortality rate for river-inhabiting harbor seals and California sea lions. Like Alternative 2 or 3, Alternative 4 would eliminate all potential incidental take of harbor porpoise and other cetaceans that could possibly occur under Alternative 1.

4.8.3 Marine Invertebrates

Four of the five types of salmon fishing authorized in Puget Sound and the Strait of Juan de Fuca – sport, purse seine, beach seine, reef net, or gillnet – do not actively operate in the benthic zone where marine invertebrates occur. Beach seining is an exception, where a seine net is dragged along the bottom as it is hauled ashore. However, beaching seining generally occurs over sandy or pebbly substrates to avoid snagging on exposed rocks, therefore not occurring where encounters of benthic invertebrates are most likely to occur. Further, captured marine invertebrates (e.g., crabs, sea stars) are easily released unharmed.

The sport fishing "mooching" technique involves bouncing weight and bait along the seafloor. An occasional sea pen, anemone, or sea star is snagged, but all are usually released unharmed. The only invertebrate observed by Noviello (1999) during observation of 1,090 hookups during the 1997 and 1998 Puget Sound sport fishery was a single sea star.

Set gillnets that reach to the seafloor commonly capture crabs as a bycatch, although they are generally released alive. A growing concern, however, involves ghost nets, especially gillnets that have been lost and continue to fish (High 1985). Although not yet quantified, these nets have been observed to continually capture crabs for years (personal communication with Wayne Palsson, Washington Department of Fish and Wildlife, Research Scientist, February 17, 2003). One 575-foot-long net lost in Puget Sound contained an estimated 1,000 female crabs (Breen 1990). During the removal of derelict gear by the Natural Resource Consultants (see Subsections 3.3.5 and 3.8.1), divers reported high sedimentation rates on many of the nets that had apparently suffocated sessile animals on the hard rock substrate. Adjacent areas, without derelict nets, were observed to have a relatively higher density of sessile and bottom dwelling organisms such as sea urchins and sea cucumbers. Several of the nets had rolled into long tubes of webbing and lead line that was entangled on a rock pinnacle or reef edge at

one end. The tube of net was observed to sweep back and forth over the gravel seabed in an arc. The divers reported no animals or vegetation on the seabed in the arc swept by these nets. These results are too recent (April 5, 2004) for rigorous estimates of cumulative impacts to populations of fish and benthic organisms to be available.

4.8.3.1 Alternative 1 – Proposed Action/Status Quo

The Proposed Action would likely result in no or very low impacts to marine invertebrates as the five types of Puget Sound salmon fishery do not operate on the seafloor in a manner that is lethal to benthic organisms. The only concern identified that requires further investigation is the long-term lethality of derelict nets lost during gillnet fisheries.

4.8.3.2 Alternative 2 – Escapement Goal Management at the Management Unit Level

Under Alternative 2, salmon fisheries would occur primarily in rivers. Very limited nearshore, marine-area harvest would occur in Dungeness Bay (Marine Catch Area 6D), Tulalip Harbor (Marine Catch Area 8D), and adjacent to the Hoodsport Hatchery in southern Hood Canal (Marine Catch Area 12H) using beach seines and set gillnets. There would be no measurable impact to marine invertebrates. Compared to Alternative 1, Alternative 2 would eliminate ghost net concerns, except those left by previous fishing activities.

4.8.3.3 Alternative 3 – Escapement Goal Management at the Population Level with Terminal Fisheries Only

Under Alternative 3, no salmon fishing would occur in the marine waters of Puget Sound. Consequently, there would be no avenues for impact to marine invertebrates. Compared to Alternative 1, Alternative 3 would eliminate ghost net concerns, except those left by previous fishing activities.

4.8.3.4 Alternative 4 – No Action/No Authorized Take

Like Alternative 2, no salmon fishing would occur in marine waters of Puget Sound or the Strait of Juan de Fuca with Alternative 4; therefore, there would be no mechanisms to potentially impact marine invertebrates. Like Alternative 2, Alternative 4 would eliminate ghost net concerns raised under Alternative 1, except those left by previous fishing activities.

4.8.4 Threatened and Endangered Wildlife Species

Seven threatened and endangered wildlife species are at least occasionally found in the inland marine waters of Washington. These include the marbled murrelet, California brown pelican, bald eagle, Steller sea lion, humpback whale, fin whale, and Pacific leatherback turtle. All, except possibly the bald eagle, have been reported entangled in fishing nets. However, only the marbled murrelet has been reported as a bycatch in the Puget Sound salmon fishery (Pierce et al. 1996; and Melvin et al. 1998).

Further, the total numbers of pelicans, Steller sea lions, humpback whales, fin whales, and leatherback turtles that annually enter Puget Sound are sufficiently small that total mortality of these animals would not exceed 10 percent of stock PBRs.

Salmon, especially runs of fall coho and chum salmon that extend into winter (December-February), are an important food source for hundreds of bald eagles wintering in Washington. However, annual fishing harvest managed for sustainable levels and abundance of fall chum and coho salmon has increased over the last decade. In turn, this management strategy ensures that enough chum and coho salmon return annually to support a viable wintering eagle population.

Carter et al. (1995) expressed concern that marbled murrelet mortality from Puget Sound gillnet fishing was likely substantial, based on extrapolations from the 1979 to 1980 Barkley Sound, British Columbia, murrelet densities and mortality rates. However, Pierce et al. (1996) observed the 1994 sockeye gillnet fishery in Marine Catch Areas 7 and 7A to quantify seabird and marine mammal interactions, and recorded only one murrelet entanglement, in Marine Catch Area 7. This individual was released alive. The entanglement rate was estimated to be 0.00158 per set in Area 7, or 0.00045 per set for the combined Marine Catch Area 7 and 7A fishery. Wide confidence limits were associated with these estimates of entanglement rate. It was estimated based on extrapolation that the 1994 fishery killed 15 birds, and it was concluded that the occurrence of marbled murrelet entanglement in these areas was "an extremely rare event." Melvin et al (1999) conducted an experimental test of a gillnet designed to reduce seabird entanglements, during the 1996 sockeye fishery. They observed one marbled murrelet capture in 642 sets, and categorized the capture as "extremely rare." Both studies suggest that murrelet encounters with fisheries are so rare that sufficient sample sizes are difficult to generate to develop meaningful estimates of mortality. Courtney et al. (1997) surveyed for marbled murrelets in several fishing areas throughout Puget Sound, and concluded that the potential for entanglement was generally localized and unpredictable, with Hood Canal a potential location for future problems. Having observed large flocks of marbled murrelets in northern Hood Canal in the fall, Courtney et al. (1997) noted the potential there for murrelet interactions with gillnet fisheries. Finally, however, observations by Beauchamp et al. (1999) suggest that a portion of the seasonal influx of marbled murrelets into the inland waters of Washington in the fall and winter are breeding birds from British Columbia (rather than the listed U.S. population).

Conclusions from information gathered in the 1990s are that the potential for substantial marbled murrelet mortality from gillnets remains in the Puget Sound region, although actual observation of entanglement events is extremely rare. However, with the current requirements on the non-treaty gillnet

fishery in Marine Catch Areas 7 and 7A to utilize nets designed to reduce alcid entanglement, and to preclude fishing during dawn hours when alcids are actively feeding, murrelet mortality rates from the 1990s may be reduced by 70 to 75 percent based on research by Melvin et al. (1999).

4.8.4.1 Alternative 1 – Proposed Action/Status Quo

The Proposed Action would result in gillnet fishing effort in the Strait of Juan de Fuca and Puget Sound similar in area but less intense than that which occurred in the mid-1990s, when studies on marbled murrelet encounters with gillnet fisheries were conducted. These studies (Pierce et al. 1996; and Melvin et al. 1999) failed to show substantial mortality to marbled murrelets from Puget Sound gillnet fisheries then. Mortality is probably greatly ameliorated by the new fishing gear and fishing schedules implemented in the non-treaty fishery, and the shorter fishing season and reduced fishing effort in Marine Catch Areas 7 and 7A typical of recent years in both tribal and non-tribal fisheries. Consequently, there is no evidence that Puget Sound gillnet fisheries as proposed under the Puget Sound Chinook Harvest Resource Management Plan (Alternative 1) would substantially impact local marbled murrelet populations. Past consultations conducted by the U.S. Fish and Wildlife Service (USFWS), pursuant the Endangered Species Act, concluded that Puget Sound fisheries do not jeopardize the continued survival and recovery of the threatened marbled murrelet population. The previous incidental take allowance for treaty tribal salmon fisheries expired in December 2003 (USFWS). The incidental take allowance for Puget Sound non-tribal commercial and sport salmon fisheries extends through 2011 (USFWS 2001). The Puget Sound treaty tribes recently completed a consultation with the USFWS on the effect of fisheries under the Proposed Action on marbled murrelets (USFWS 2004). They specify terms and conditions and conservation measures that are designed to minimize the effects on encounters with live murrelets, minimize the potential to exceed the allowable take and recommend evaluation of alternative salmon harvest methods and fishery implementation to reduce marbled murrelets entanglement and encounters. As described in Subsection 4.8.4, the current requirements to use nets designed to reduce alcid entanglement, and the preclusion of fishing during dawn hours when alcids are actively feeding are example of these types of measures that have been implemented in non-tribal salmon fisheries.

4.8.4.2 Alternative 2 – Escapement Goal Management at the Management Unit Level

Salmon fisheries would primarily be confined to rivers under Alternative 2, so there would be very low risk of entanglement of marbled murrelets, although the harvest opportunity in Tulalip Harbor (Marine Catch Area 8D) possible under Alternative 2 would involve gillnet fishing where aggregations of murrelets have been observed in the fall (Courtney et al. 1997). Alternative 2 would therefore pose a

lower risk to marbled murrelets than Alternative 1, though this reduced level of risk cannot be quantified with the available data. Because marbled murrelet bycatch would not occur under Alternative 2, this alternative would be considered to have a beneficial impact when compared to Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.4.3 Alternative 3 – Escapement Goal Management at the Population Level with Terminal Fisheries Only

Under Alternative 3, salmon harvest would be limited to freshwater rivers only. No fishing would occur in marine waters inhabited by marbled murrelets. Therefore, this alternative would have no potential to affect local marbled murrelet populations, and would eliminate the very small bycatch risk posed by Alternative 1. Because this bycatch would not occur under Alternative 3, it would be considered to have a beneficial impact when compared with Alternative 1; however, the magnitude of the beneficial impact is considered low.

4.8.4.4 Alternative 4 – No Action/No Authorized Take

Like Alternative 3, Alternative 4 would result in no harvest in marine waters where marbled murrelets are found. Consequently, this alternative would have no impact on marbled murrelets and, like Alternative 3, would eliminate the very low risk of bycatch posed by Alternative 1.

4.8.5 Wildlife Indirect Effects

Direct mortality of adult seabirds (primarily alcids) indirectly affects the abundance of subsequent breeding populations. Mortality of females could be more significant in this regard. Mortality of juvenile birds can also depress production, but the effect is discounted to the extent juveniles might otherwise die from natural causes before they reach sexual maturity or breed. The age composition (i.e., adults vs. juveniles) of seabirds entangled in Puget Sound fisheries varies among species. A greater proportion of entangled rhinoceros auklets are young-of-the-year, compared to common murres (Thompson et al. 1998), in part due to proximity of auklet colonies to fishing areas. The magnitude of fishery-related mortality of alcids, relative to other natural or human causes has not been quantified. It is known to be highly variable and unpredictable, as is natural mortality. Other known causes of significant mortality include recent oil spills; predation by eagles, gulls, and corvids; and reduction in marine productivity due to the El Nino phenomenon (Manuwal et al. 2001).

Indirect effects at a finer scale (e.g., mortality impacts on sub-populations of common murres or marbled murrelets that breed in Oregon, Washington, or British Columbia), are also possible, and could affect the diversity within species, but these effects are not quantifiable at this time. Thompson et al.

(1998) concluded that common murres from both Oregon and Washington colonies are entangled in Puget Sound fisheries.

The fishing regime envisioned under Alternative 1 would have greater indirect effects on alcid seabirds than Alternative 2, 3 or 4, under which marine-area fisheries with the potential to entangle seabirds would be closed. The currently stable status of common murres and rhinoceros auklets suggests that these species are resilient to the cumulative effects of human-caused and natural mortality. The threatened status of marbled murrelets in Washington warrants higher concern over all sources of mortality. But the best available information (Pierce et al 1994; and Melvin et al 2001) indicates that entanglement in gillnet fisheries occurs very rarely, so it is difficult to conclude that eliminating this source of mortality would have any measurable beneficial effect, given the relatively greater constraints imposed by habitat and natural predation.

Because of their indirect effect on the abundance of juvenile salmon in subsequent years, the Proposed Action or alternatives imply some potential for altering the food supply of piscivorous seabirds. The alternatives to the Proposed Action (Alternative 1), particularly Alternative 4, would result in higher spawning escapement of salmon. It is not certain, however, that substantially higher escapement will, in the long term, necessarily result in higher production of juvenile salmon. Nor is there information available to support the contention that the current abundance of juvenile salmonids constrains the survival of any seabird species, or that secondary productivity in Puget Sound constrains survival of juvenile salmonids or seabirds. So it is not possible to speculate that increasing the abundance of juvenile salmonids would have a measurable positive effect on predators, or negative effect on competition. Increasing the escapement of adult salmon to the degree projected under Alternatives 2, 3, or 4 would, for some period through the fall and winter, increase the food supply for a wide variety of vertebrate species known to utilize this resource (Cederholm et al. 1999). The accumulation of carcasses and material in the lower reaches of streams generates a seasonal pulse of nutrients to estuarine and nearshore marine areas, with potential indirect benefit to many other fish and invertebrate species. Uptake and transport of these nutrients through the food chain would occur over subsequent years. Though carcass enhancement has been experimentally shown to increase local primary and secondary production, and enable higher growth rates among juvenile salmon and other resident salmonids (discussed in Subsection 3.3.6, Marine-Derived Nutrients from Salmon Spawners – Affected Environment), information is lacking to quantify the long-term direct or indirect effects on communities or individual species.

The indirect effects of higher juvenile salmon abundance, were that to occur as a consequence of Alternatives 2, 3, or 4, on the abundance of other fish and invertebrate species, much less their avian or mammalian predators, cannot be predicted with any certainty. Intuitively, any increases in subadult or adult salmon could increase predation on forage fish species such as Pacific herring, smelt, and sandlance. This effect would be pronounced during periods when migrating salmon are at highest density in Puget Sound (i.e., as they migrate toward the outer coast and as they return to spawn); however, adult salmon feed less frequently as they approach maturity and enter fresh water. The potential for competition with other species that also utilize these species would exist during these periods. Though production of these forage species is depressed in Puget Sound, there is no information to support a conclusion that their current productivity now constrains the growth and survival of their predators, or would do so at higher predator abundance.

The reduction of net fisheries as contemplated under Alternative 2, 3, or 4 would reduce the rate of potential gear loss in Puget Sound. Some nets that are lost in Puget Sound fisheries, especially gillnets, continue to fish, entangling marine mammals, marine birds, and invertebrates such as crabs (High 1985, and Breen 1990). The influence of these ghost nets on the mortality rate of any given species, however, is presently unknown, and may not be significant. Nevertheless, there is enough concern that concerted efforts are presently being undertaken by the Northwest Straits Commission and Washington Department of Fish and Wildlife to remove tons of these derelict nets from the Puget Sound ecosystem (Derelict Fishing Gear Removal Project).

Because salmon may contribute a large proportion of the diet of southern resident killer whales (Ford et al. 1998), fisheries that reduce the abundance of adult salmon in Puget Sound may indirectly impact this species. This hypothesis is based on the as-yet-undemonstrated assumption that the current total abundance of salmon, including hatchery production, that rear or migrate through Puget Sound, is significantly lower or has declined in coincidence with the observed decline in the abundance of southern resident killer whales. In evaluating the status of killer whales, Krahn et al. (2002) did not conclude that prey availability affected southern resident killer whales. However, in the absence of marine-area fisheries, particularly as envisioned under Alternatives 2, 3, or 4, the increase in availability of salmon could have beneficial effects on killer whales by increasing local prey availability.

Cederholm et al. (2001) identified nine wildlife species with strong consistent links to salmon. Mergansers and harlequin ducks feed on drift eggs, Caspian terns and osprey on freshwater juveniles, bald eagles on saltwater subadults and carcasses, killer whales on saltwater adults, and bears and river

otters on spawning adults and carcasses. Cederholm et al. (1989) found black bears on the Olympic Peninsula to forage heavily on salmon carcasses, much like black bears in western Canada and Alaska. However, most bear diet studies in Washington show a consistent lack of black bear use of salmon (Cederholm et al. 2001). Stable isotope studies by Hildebrand et al. (1996) suggested that grizzly bears inhabiting the Columbia Basin prior to European settlement foraged heavily on the large salmon runs that occurred then. Only about 5-20 grizzly bears now occur in Washington (North Cascades) and the importance of salmon to their diet is unknown. Nevertheless, all nine species strongly linked to salmon could potentially benefit from increased salmon production in the river tributaries of Puget Sound, although the benefit is not quantifiable.

4.8.6 Cumulative Effects on Wildlife

NEPA defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR1508.7)." For the purposes of this discussion, the terms "effects" and "impacts" will be considered synonymously with "consequences," and consequences may be negative or beneficial. This section presents an analysis of the cumulative effects (negative or beneficial) of the Proposed Action in the context of other local, state, tribal, and federal management activities in the Puget Sound region on fish resources and related economic conditions.

The geographic scope of the cumulative effects analysis area includes the entire Puget Sound region. The analysis area covers both inland and marine environments that are managed under laws, policies, regulations, and plans having a direct or indirect impact on fish. The substantive scope of the cumulative analysis is predicated on a review of laws, policies, regulations, and plans that specifically pertain to fish-related management activities or that have an indirect negative or beneficial effect on fish resources and related economic conditions. These laws, policies, regulations, and plans are described in Section 1 and Appendix F. Because of the geographic scope of the analysis area, it is not feasible to analyze all habitat-specific activities that are occurring, have occurred in the past, or that will occur in the future in a quantitative manner. By reviewing laws, policies, regulations, and plans, the analysis will capture the objectives of any management activity that is occurring or planned to occur that may interface with fish resources within the Puget Sound region. It is assumed that no management activity is occurring or would occur outside of an implemented law, policy, regulation, or sanctioned plan at the federal, tribal, state, or local level. Although the analysis is necessarily qualitative, it provides a thorough review of all other activities within the region that, when combined

with the Proposed Action, could have a negative or beneficial affect on fish resources and related economic conditions.

Table 4.3.8.2-1 summarizes the potential cumulative effects on fish resources of implementing the Proposed Action with the effects of these existing laws, policies, regulations, and plans. The table below summarizes the potential cumulative effects on wildlife of the Proposed Action and other plans, policies and programs in the Puget Sound region.

The Proposed Action is implementation of the Puget Sound Chinook Harvest Resource Management Plan (RMP), jointly prepared by the Washington Department of Fish and Wildlife (WDFW) and the Puget Sound Treaty Tribes (co-managers). Factors common to the relationship between the RMP and the various existing plans, policies and programs include: 1) the Resource Management Plan would provide protection to Puget Sound chinook salmon by conserving the productivity, abundance, and diversity of populations within the Puget Sound Chinook Evolutionarily Significant Unit (ESU), while managing harvest of strong salmon stocks; and 2) conserving productivity requires biological integrity in the freshwater systems in which salmon spawn and rear.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws.

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
Fish and Wildlife Coordination Act, 1956, as amended in 1964 (FWCA).	The FWCA recognizes "the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation."	The Puget Sound Chinook Salmon Resource Management Plan would allow the harvest of salmon in coordination with ongoing conservation and rehabilitation efforts for chinook salmon. With an estimated value of $35 million ($16.2 million commercial plus $18.8 million recreational), the Puget Sound fishing industries are important to the Nation's economy. The Proposed Action would be consistent with the FWCA by recognizing the vital contribution of Puget Sound chinook salmon and local wildlife populations to the Nation and our national economy. It is predicted that implementation of the Resource Management Plan, in combination with the FWCA, would strive to balance considerations of the national economy, while also providing for fish and wildlife conservation.
Washington State Shoreline Management Act of 1971 (SMA).	The SMA was adopted in Washington in 1972 with the goal of "prevent[ing] the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." The provisions of this law are designed to guide the development of the shoreline lands in a manner that will promote and enhance the public interest. The law expresses the public concern for protection against adverse effects to public health, the land and its vegetation and wildlife, and the aquatic life of the waters.	Rearing habitat within shoreline areas of Washington State is essential to conserving the productivity of Puget Sound chinook salmon. Consequently, the Proposed Action would be consistent with the SMA by ensuring that harvest works in concert with habitat protection efforts under the SMA. Accordingly, it is predicted that implementation of the Resource Management Plan, in combination with the SMA, would protect fish from adverse effects associated with uncoordinated and piecemeal development of the state's shorelines. Puget Sound marine shorelines are also critical nesting and foraging habitat for bald eagles, and nearshore shallow-water areas are used by a variety of seabirds, including marbled murrelets. As with fish, implementation of the Resource Management Plan in combination with the SMA is predicted to aid in the protection of wildlife (e.g., reduced entanglement risk) and their nearshore breeding and foraging habitat.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
The National Marine Sanctuaries Act. Also known as Title III of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA).	The MPRSA authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or a aesthetic qualities as National Marine Sanctuaries. One of the purposes and policies of the MPRSA is "to maintain the natural biological communities in the national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes."	Protecting the marine environment where chinook salmon mature is important to conserving the productivity of Puget Sound chinook salmon. Consequently, the Proposed Action would be consistent with the MPRSA by maintaining chinook salmon populations of the natural biological communities in the marine environment. Accordingly, it is predicted that implementation of the Resource Management Plan, in combination with the MPRSA, would strive to restore and enhance natural habitats, populations, and ecological processes of fish. Marine Sanctuaries also provide protection for many species of marine mammals and seabirds that seasonally use Puget Sound. Those that forage on salmon, or are susceptible to net entanglement, are predicted to further benefit from implementation of the Resource Management Plan.
Coastal Zone Management Act of 1972 (CZMA), as amended through The Coastal Zone Protection Act of 1996.	The CZMA declares a national policy "to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations by "the protection of natural resources, including wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitat, within the coastal zone."	Chinook salmon are one of the Nation's resources within the coastal zone regulated by the CZMA. The Proposed Action would be consistent with the CZMA by encouraging preservation and protection of Puget Sound chinook salmon and their habitat within the coastal zone for existing and succeeding generations, and by ensuring that harvest is consistent with the production and capacity of the habitat. Accordingly, it is predicted that implementation of the Resource Management Plan, in combination with the CZMA, would preserve, protect, restore or enhance the fish resources of the Nation's coastal zone. The coastal zone is also important to many species of marine wildlife, including marbled murrelets and bald eagles. The CZMA in combination with the Proposed Action is predicted to benefit marbled murrelets and other seabirds through habitat protection and reduced net entanglement risk, and increased fish prey in the case of bald eagles and other fish-eating predators/scavengers.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
Marine Mammal Protection Act of 1972, as amended through 1996 (MMPA).	The MMPA establishes a Federal responsibility to conserve marine mammals, with management vested in the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) for cetaceans and pinnipeds other than walrus. The MMPA states that the "Secretary must undertake a program of research and development for improving fishing methods and gear to reduce to the maximum extent practical the incidental taking of marine mammals in commercial fishing." To meet this requirement, the "Secretary must issue regulations to reduce to the lowest practical level the taking of marine mammals incidental to commercial fishing operations." The Secretary of Commerce has issued regulations that prohibit deterrent devices that might seriously injure or kill a marine mammal, and that require fishermen to report unintentional marine mammal mortality.	The Proposed Action would be consistent with the MMPA to conserve marine mammals because the fisheries would be in compliance with Department of Commerce regulations to reduce to the lowest practical level the take of marine mammals incidental to commercial fishing operations. Although not specifically addressed in the Proposed Action, Department of Commerce regulations require Puget Sound fishermen to use non-lethal deterrent devices and to report unintentional marine mammal mortality. As chinook salmon are prey of marine mammals, implementation of the Proposed Action, in combination with the MMPA, will aid in the maintenance and recovery of marine mammal populations by ensuring that enough fish escape to produce more in subsequent generations as habitat improves.
The Endangered Species Act of 1973, as amended through December, 1996 (ESA).	The purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species…" On July 10, 2000, NMFS issued a rule under section 4(d) of the ESA (referred hereafter as the 4(d) Rule). The 4(d) Rule provided limits on the application of the take prohibitions; i.e., take prohibitions would not apply to the plans and activities set forth in the rule if those plans and activities adequately address criteria of the rule, including that implementation and enforcement of the resource management plan will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs.	The Puget Sound Chinook Salmon ESU is listed as threatened under the ESA. The Proposed Action to implement the Puget Sound Chinook Salmon Resource Management Plan includes a condition that the Secretary of Commerce will determine whether that the Resource Management Plan adequately addresses the criteria outlined in Limit 6 of the ESA 4(d) Rule. Consequently, the Proposed Action would be consistent with the ESA by meeting these criteria designed to foster goals and objectives of the ESA, including to avoid appreciably reducing the likelihood of survival and recovery of Puget Sound Chinook Salmon ESU. The ESA would not only have a beneficial impact to listed Puget Sound chinook salmon, but species listed under the ESA also include predators of chinook salmon such as bull trout and bald eagles. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the ESA, would potentially have both unquantifiable beneficial and adverse impacts to fish resources and listed wildlife species such as bald eagles that forage on fish.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
Habitat Conservation Plans	Section 10 of the Endangered Species Act requires that Habitat Conservation Plans be developed and implemented as a condition of the incidental take permit process. These plans define the impacts of a proposed action on listed species, and the steps an applicant intends to take to minimize and mitigate these impacts.	Listed species inhabiting Puget Sound for which habitat conservation plans have been developed include the marbled murrelet (seven plans) and the bald eagle (six plans). All of these plans involve preserving forest habitat for these species in the general Puget Sound basin. By reducing mortality risks (net entanglement) to marbled murrelets and enhancing the foraging base for bald eagles, implementation of the Proposed Action in combination with the conservation goals of HCPs will benefit marbled murrelets. The HCPs in question are: Cedar River Watershed City of Tacoma, Tacoma Water Plum Creek Timber I-90 Port Blakely RB Eddy Tree Farm Simpson Timber NW Operations Washington DNR Forest Lands West Fork Timber (formerly Murray Pacific).
ESA Recovery Plans	The 1982 and 1988 amendments to the Endangered Species Act of 1973 require that recovery plans be developed and implemented to promote the conservation of listed species.	Recovery plans have been developed for the seven threatened and endangered wildlife species (Pacific leatherback turtle, marbled murrelet, bald eagle, California brown pelican, Steller sea lion, humpback whale, and fin whale) that at least occasionally inhabit Puget Sound. Implementation of the Proposed Action would likely reduce net entanglement risks for those species that potentially interact with the Puget Sound fisheries (the turtle, seabirds, and marine mammals), and benefit those listed species that forage on salmon (bald eagles and Steller sea lions). Thus, implementation of the Proposed Action in combination with the implementation of actions in the recovery plans should benefit these listed species.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
The Clean Water Act, 1977 (CWA). A 1977 amendment to the Federal Water Pollution Control Act (FWPCA) was titled "The Clean Water Act."	The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As stated in the CWA, maintaining or restoring water quality "provides for the protection and propagation of fish, shellfish, and wildlife…"	Primarily because the CWA would maintain water quality that provides for the protection and propagation of fish, it is predicted that implementation of the Proposed Action, in combination with the CWA, would have a net beneficial impact on fish resources. These benefits would also accrue to the wildlife species that forage on these fish.
The Migratory Bird Treaty Act	The MBTA "absolutely forbids killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior."	By reducing the risks of net entanglement to migratory seabirds such as murrelets, auklets, and murres, the Proposed Action in combination with the MBTA is predicted to benefit migratory birds.
The Bald Eagle and Golden Eagle Protection Act	This legislation was first enacted in 1940 to protect bald eagles by prohibiting the take, sale, or purchase of these birds. Today, it provides a third level of protection for bald eagles along with the ESA and the MBTA.	Implementation of the Proposed Action is predicted to benefit bald eagles by increasing the available fish resources on which they forage. Consequently, the Proposed Action in combination with the Bald Eagle and Golden Eagle Protection Act is predicted to benefit bald eagles.
The Treaty between the Government of Canada and the Government of the United States of America concerning Pacific Salmon, 1985, including 1999 revised annexes (Pacific Salmon Treaty).	The Pacific Salmon Treaty calls on the U.S. and Canada (Parties) to conduct its fisheries in a manner to "prevent overfishing and provide for optimum production." The Pacific Salmon Treaty defines "overfishing" as "fishing patterns which result in escapements significantly less than those required to produce maximum sustainable yields [MSY]." Annex IV, Chapter 3, Chinook Salmon of the Pacific Salmon Treaty further states that the Parties shall establish a chinook salmon management program that "sustains healthy stocks and rebuilds stocks that have yet to achieve MSY or other biologically-based escapement objectives." Salmon subject to the Pacific Salmon Treaty include Pacific salmon stocks that originate in the waters of one Party and subject to interception by the other Party.	Puget Sound chinook salmon are intercepted in Canadian fisheries under the authority of the Pacific Salmon Treaty. The Proposed Action accounts for all sources of fishery-related chinook salmon mortality, including mortality related to Canadian fisheries. Although the Proposed Action would allow exploitation rates that would result in escapements less than those required to produce maximum sustainable yields in some years, it would, overall, sustain healthy populations and rebuild stocks toward maximum sustainable yield. Consequently, the Proposed Action would be consistent with the Pacific Salmon Treaty. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the Pacific Salmon Treaty, would have a net beneficial impact on the wildlife species that forage on these fish.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, commonly referred to as the Northwest Forest Plan (NFP), 1994.	The NFP is an integrated, comprehensive design for ecosystem management, intergovernmental and public collaboration, and rural community economic assistance for federal forests in western Oregon, Washington, and northern California. The management direction of the NFP consists of extensive standards and guidelines, including land allocations that comprise a comprehensive ecosystem management strategy. Aquatic conservation strategy objectives outlined in the NFP (Attachment A of the NFP) include, but are not limited to: "Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted;" and, "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities."	The Proposed Action would be consistent with the intent of NFP to maintain and restore the distribution, diversity, and complexity of watersheds. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the NFP, would have a net beneficial impact on fish resources. Implementation of the NFP also benefits wildlife species such as marbled murrelets (protecting forest breeding habitat), and bald eagles (protecting both breeding and foraging habitat). Together, implementation of the NFP and Proposed Action are predicted to benefit marbled murrelets and bald eagles.
Gravel to Gravel, Regional Salmon Recovery Policy for the Puget Sound and the Coast of Washington, Western Washington Treaty Tribes, July 25, 1997 (Gravel to Gravel Policy).	Major elements of the Gravel to Gravel Policy are to provide habitat protection and restoration, ensuring abundant spawners, managing fisheries, and integrating hatchery production.	The Proposed Action would be consistent with the Gravel to Gravel policy of managing fisheries to ensure abundant spawners. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the Gravel to Gravel Policy, would have a beneficial impact on fish resources, which in turn would benefit wildife species that forage on these fish.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids (Wild Salmon Policy). Adopted by Washington Fish and Wildlife Commission on December 5, 1997. (Despite the title, the tribal governments have not adopted this Wild Salmon Policy.)	The stated goals of the Wild Salmon Policy include restoring Washington stocks of wild salmon and steelhead to healthy, harvestable runs by "managing commercial and sport fishing to ensure enough wild runs return to spawn while providing fishing opportunities where possible."	The Proposed Action would be consistent with the intent of the Wild Salmon Policy to manage commercial and recreational fishing in a manner that ensures enough wild salmon return to spawn while providing fishing opportunities where possible. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the Wild Salmon Policy, would have a beneficial impact on fish resources, and the wildlife species that forage on these fish.
Statewide Strategy to Recover Salmon, September 21, 1999 (SSRS).	The goal of the SSRS is to "[r]estore salmon, steelhead, and trout populations to healthy and harvestable levels and improve the habitats on which fish rely." The SSRS is the long-term vision or guide for salmon recovery within the State of Washington.	The Proposed Action would be consistent with the intent of SSRS to restore salmon populations to healthy and harvestable levels. Accordingly, it is predicted that implementation of the Proposed Action, in combination with the SSRS, would have a beneficial impact on fish resources, and the wildlife species that forage on these fish.
Local Plans, Policies, and Programs	Local activities that influence cumulative effects to fish include, but are not limited to: Water Supply Projects: Local water departments operate and maintain water reservoirs, pump stations, and water mains to deliver potable water to their customers. Local projects have minimized the adverse impacts of water withdrawal by installing additional water gauges to monitor flows and regulate water use, reducing water intake during critical environmental periods, and by purchasing existing water rights to return water to the system. Levee Maintenance: A levee is a natural or manmade structure, usually an earthen berm or riprap, that parallels the course of a river. It functions to prevent flooding of the adjoining countryside. However, it also confines the flow of the river resulting in deeper, faster flows. In recent years, local levee maintenance projects have included setting back or removing levees. Stormwater Management: Surface water runoff results from rainfall or	Many of these local activities are conducted in cooperation with federal, tribal, and state actions. The fisheries that would be allowed by the Proposed Action are predicted to have minimal to negligible effect on Washington State water quality. Because many of these local plans, policies, and programs would maintain water quality that provides for the protection and propagation of fish, it is predicted that implementation of the Proposed Action, in combination with local plans, policies, and programs, would have a net beneficial impact on fish resources, and the wildlife that feed on these fish.

Table 4.8.6-1 Cumulative effects on wildlife of the Proposed Action in combination with various plans, policies and laws. *continued*

Federal/Tribal/State/Local		
Plans, Policies, and Programs (in chronological order of the earliest to the most recent)	**Description and Intent**	**Cumulative Effect when Combined with the Proposed Action**
	snow melt that does not infiltrate the ground or evaporate due to impervious surfaces. Instead, this runoff flows onto adjacent land, or into watercourses, or is routed into storm drainage collection systems managed by local entities. Local cities and counties are in the process of developing watershed plans, subbasin plans, and revising codes to minimize the adverse impacts of surface water runoff. Wastewater Treatment Projects: Municipal wastewater treatment plants process domestic sewage, and commercial and industrial wastewaters. Stormwater and groundwater infiltration may also enter wastewater treatment plants, though efforts are being made to segregate these flows. Local cities and counties are in the process of developing Facilities Plans and revising codes to minimize adverse impacts associated with wastewater treatment projects. Salmon Recovery Efforts: Local communities are undertaking activities to protect listed species and their habitat. Examples of activities conducted include, but are not limited to: reducing barriers to fish passage; improving habitat forming processes; increasing channel diversity; improving estuarine habitat; and enhancing streamside vegetation. Watershed Conservation Plans: As mandated by the 1998 State of Washington Watershed Management Act and Salmon Recovery Planning Act, counties are conducting watershed planning to address water quality, water quantity, and salmon habitat issues. Bald Eagle Management Plans: In 1984, the Washington State Legislature enacted laws to protect bald eagle habitat through WDFW management processes. From these laws, bald eagle protection rules were developed, requiring site-specific bald eagle management plans be developed where landowner-proposed activities may adversely impact bald eagle habitat. Since 1987, more than 1,150 plans have been developed, the majority in the Puget Sound region.	